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Colonization of Artificial Islands in the Kazakh Sector of the Caspian Sea by the Aquatic Snake *Natrix tessellata* (Squamata: Natricidae) . . . . . Olivier S. G. Pauwels, Maral Kadeyeva, Victoria Kovshar, Aidyn Sakharbayev, Fedor A. Sarayev, Samat Sarsengaliyev, Sergey Ukhov and Sagiden Yerbulekov 133

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Colonization of Artificial Islands in the Kazakh Sector of the Caspian Sea by the Aquatic Snake *Natrix tessellata* (Squamata: Natricidae)

Olivier S. G. Pauwels [1], Maral Kadeyeva [2], Victoria Kovshar [3], Aidyn Sakharbayev [2], Fedor A. Sarayev [4], Samat Sarsengaliyev [2], Sergey Ukhov [2] and Sagiden Yerbulekov [2]

Abstract

We report the colonization by the aquatic Dice snake *Natrix tessellata* of five artificial islands (A Island, D Island, DC 05, EPC 03 and EPC 04), built in the 2000s to house oil industry activities in the Kazakh sector of the Caspian Sea, western Kazakhstan. We discuss possible modes of colonization (e.g., accidental transport by boat originating from the Bautino harbor in Mangystau Region; active swimming from the coast). We present several observations of predation on fish (Cyprinidae: *Carassius auratus*; Gobiidae: *Neogobius caspius*, *N. fluviatilis* and *N. melanostomus*) and on the Laughing frog (Ranidae: *Pelophylax ridibundus*).

Keywords

Biodiversity, herpetofauna, aquatic fauna, gobies, Kazakhstan, Russia, Eurasia, Caspian Sea, oil and gas industry.

Introduction

The Dice snake *Natrix tessellata* (Laurenti, 1768) has an immense distribution extending from Germany to China (isolated westernmost records, namely in Belgium, probably result from deliberate releases, according to Meirte and Pauwels, 1999). It is aquatic, and frequents all kinds of stagnant or flowing freshwater habitats, including brackish waters and seashores (Brischoux and Kornilev, 2014; Van der Meijden and Chiari, 2006). Among the seashores it frequents are those of the northern Caspian Sea, shared between Russia and Kazakhstan.

Natrix tessellata is indeed well known from the Volga Delta, Astrakhan Oblast (i.e., Astrakhan Region), in Russia (see, among others, Guicking et al., 2009) and from the Ural Delta, Atyrau Oblast, in western Kazakhstan (Diarov et al., 2008; Sarayev and Pestov, 2010). The type-locality of *Coluber hydrus* Pallas, 1771, a junior subjective synonym of *Natrix tessellata*, is "Gurief Gorodok," an ancient name for Atyrau (Borkin and Litvinchuk, 2015), the administrative centre of Atyrau Oblast. The type-locality of *Enhydris caspia* Oken, 1816, another such synonym, is ''from the river Rhymnus into the Caspian Sea,'' i.e., from the Ural River (Tuniyev et al., 2011), in its delta area. The type-locality of *Tropidonotus gracilis* von Eichwald, 1831 is the mouth of the Volga River, thus in Astrakhan Region in Russia, and that of *T. tantalus* von Eichwald, 1831 is Tjub-Karagan (= Tupkaragan), i.e., at direct proximity to Bautino in Mangystau (= Mangistau) Region, western Kazakhstan.

The Kazakh sector of the northern Caspian Sea houses some of the largest oil reserves in the world, including the Kashagan oil field. Local weather conditions are characterized by extreme temperature differences between summer (as high as 40°C) and winter (as low as -40°C). The sea is on average only three or four meters deep, and the waters freeze in the winter. Because of the shallow waters combined with the movements of large ice blocks (Mayne et al., 2002), conventional rigs could not be used for oil extraction, and had to be replaced by innovative artificial islands, built with boulders from onshore quarries, aimed at protecting the extraction facilities. Ten artificial islands were created in order to exploit and export oil from the Kashagan field. Eight of them (A Island, DC 01, DC 04, DC 05, D Island, EPC 02, EPC 03 and EPC 04) are located S-SE of the Ural Delta, at more than 40 km from the mainland, and the two others (Aktote and Kairan) are located further east, closer to the mainland. During the winter, the islands are surrounded by thick ice for about four months, from early December to late March, and exposed to strong blizzards. Due to these harsh meteorological conditions and the rocky substrate, vegetation is nearly absent from these islands.

Since their construction between 2001 and 2007 (Gökalp and Düzceer, 2008), these artificial islands and other assets on the mainland are included in a large-scale environmental monitoring program (Ogar et al., 2014). Data on the presence and abundance of all zoological and botanical groups are seasonally collected. We present hereafter data we gathered on snakes on and near the artificial islands in the frame of these environmental surveys, as well as opportunistic observations made on the nearby mainland.

Material and Methods

Except for a short visit, 15–18 September 2014, by two of us (OSGP and SU), dedicated to a survey of Dice snakes on A Island (46°28'15.2"N, 52°20'03.3"E) and D Island (46°26'13.6"N, 52°15'59.4"E; Figures 1 and 2), observations were opportunistically gathered during general environmental surveys on and

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Figure 1. Biotope of *Natrix tessellata* on D Island, Kazakh sector of the northern Caspian Sea, in the summer. Photograph courtesy of NCOC Multimedia Team.

around the artificial islands between 2010 and 2015.

Snake ventral scale counts follow the method of Dowling (1951); the terminal, pointed tail tip is not included in the subcaudal count. We follow Guicking et al. (2009) in treating all populations of the *Natrix tessellata* complex as a single taxon until more phylogenetic data are available, and Kindler et al. (2013) in attributing the North Caspian populations of *Natrix natrix* to the subspecies *scutata* (Pallas, 1771). Fish taxonomy follows FishBase (www.fishbase.se).

Results

Artificial islands and offshore

In late September 2010 VK observed several Dice snakes on EPC 03 Island (46°24'20.9"N, 52°16'16.7"E). At this time there was active construction work on this island, with barges importing limestone boulders and soil from the mainland.

On 15, 16 and 18 September 2014, OSGP and SU made dedicated snake surveys on D Island. On the 15th, while surveying the Icebreaking Emergency Evacuation Vessel (IBEEV) hangar area between 17.30 and 18.00, they observed one active adult snake and examined one subadult shed skin. On 17 September 2014, they surveyed A Island from 8.30 to 10.00 A.M., and examined ten shed skins (Figure 3), among them all size classes from juveniles to adults, in all parts of the island. During

Figure 3. Shed skin of an adult *Natrix tessellata*. Photographed *in situ* by O. S. G. Pauwels on A Island, Kazakhstan, in September 2014.

Figure 2. Biotope of *Natrix tessellata* on D Island, Kazakh sector of the northern Caspian Sea, in the winter. Photograph courtesy of NCOC Multimedia Team. Within the perimeter of the island, the ice is regularly broken by incoming icebreakers.

these four days, the weather was windy, fresh and partly clouded; daytime temperatures varied between 11 and 17°C. This might explain the low number of snakes observed, while the employees working on these islands informed us that these snakes are seen in much larger numbers in mid-summer, when temperatures are sensibly higher. The employees typically observe them basking on large rocks along the sea, or actively searching for fish near the shore.

OSGP examined the habitus and scalation of two live subadult Dice snakes from D Island. These snakes, released on the spot after having been examined and photographed, were characterized as follows (paired characters given left/right):

1st specimen (Figure 4): 2 internasals; 2 prefrontals; 8/8 supralabials, on each side 4th supralabial in contact with the orbit; on each side 2nd supralabial in contact with the 1st supralabial, the nasal, the loreal and the 3rd supralabial; 1/2 suboculars; 1/1 loreal, squarish; 2/2 preoculars (upper larger than lower); 1/1 supraocular; 2/2 postoculars (lower larger than upper); 1+2+3 temporals on each side; 10/10 infralabials, on each side the five first in contact with the anterior sublingual; 2 pairs of sublinguals; 2 preventrals + 184 ventrals; a divided anal; and a complete original tail with 62 divided subcaudals.

Figure 4. Live subadult *Natrix tessellata* on D Island. Photograph by O. S. G. Pauwels in September 2014. This individual, left quiet for a few minutes after it was disturbed and feigned death, is checking if the situation is safe again.

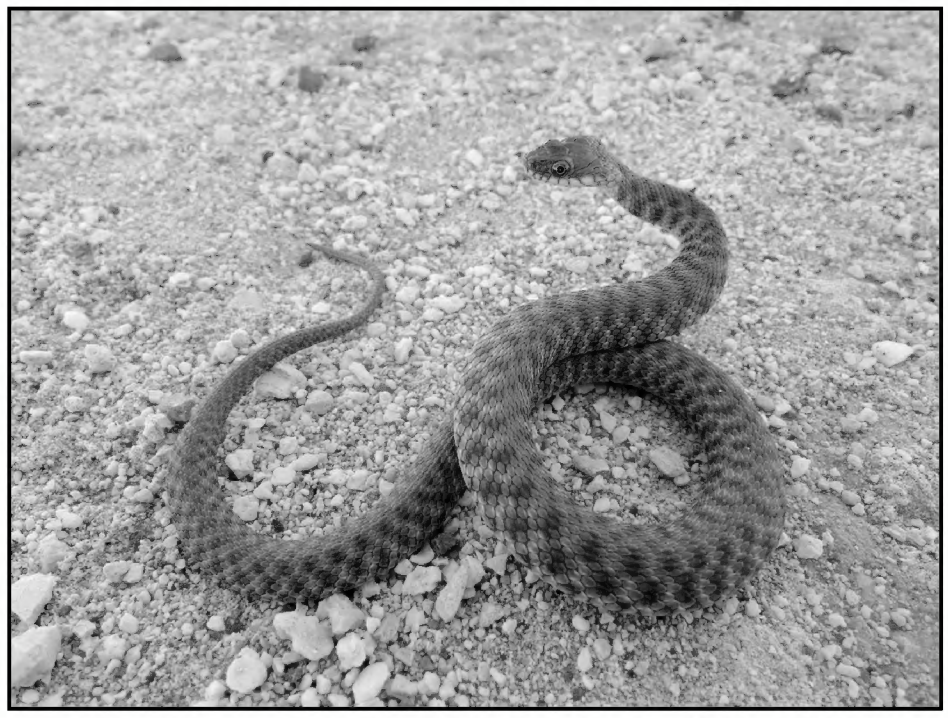

Figure 5. Another live subadult *Natrix tessellata* on D Island. Photograph by O. S. G. Pauwels in September 2014. Note the defensive posture with the flattened head.

2nd specimen (Figure 5): 2 internasals; 2 prefrontals; 8/8 supralabials, on each side 4th and 5th supralabials in contact with the orbit; on each side 2nd supralabial in contact with the 1st supralabial, the nasal, the loreal and the 3rd supralabial; 0/1 subocular; 1/1 loreal, squarish; 2 (upper larger than lower)/1 preoculars; 1/1 supraocular; 3/2 postoculars; 1+2 temporals on each side; 10/10 infralabials, on each side the five first in contact with the anterior sublingual; 2 pairs of sublinguals; 1 preventral + 192 ventrals (umbilical scar still visible on ventrals 165 to 169); a divided anal; and a complete original tail with 68 divided subcaudals.

Both specimens also showed a round pupil; 19 dorsal scale rows at one head length behind head, 19 at midbody, and 17 at one head length before vent; and keeled dorsal scales, except the lowest row.

All shed skins examined by OSGP on A and D islands also showed 8 supralabials on each side, of which the 4th was in contact with the orbit; one anterior temporal; 19-19-17 dorsal scale rows, all keeled except the first; a divided anal and divided subcaudals. None of the shed skins included a complete tail, as the tail tips of the shed skins were broken during or after the shedding. Based on scalation features, all shed skins were unambiguously attributable to *Natrix tessellata*.

Figure 7. Adult *Natrix tessellata* basking onboard the Nomad in the northern Caspian Sea in September 2014. Photograph by S. Yerbulekov.

Figure 6. Adult *Natrix tessellata* basking on boulders on the shore of EPC 04 Island. Photograph by V. Kovshar in September 2014.

On 22 September 2014 VK observed several individuals basking on rocks and foraging at EPC 04 Island (46°27'18.0"N, 52°20'26.3"E; Figure 6).

On 20 September 2014, an adult *Natrix tessellata* was observed on board our environmental survey ship *Nomad*. The ship had left Bautino on that same day. The snake was regularly seen basking every day (Figure 7), and for the rest of the time it was hiding under the ship's deck. Its presence was daily checked by SY. It left the *Nomad* on 30 September on its own initiative, when the ship bunkered at D Island.

In June 2014, an adult individual was photographed from on board the *Caspian Maria* environmental research vessel (Figure 8). It was off DC 05 Island (46°22'19.9"N, 52°12'46.4"E) where several individuals were seen basking and foraging in the sea. Several times during the study period, isolated individuals were observed in the open sea at several kilometers from the artificial islands.

Mainland

Natrix tessellata is abundant along the shore of the Bautino harbor (Figure 9) in Bautino Bay. For instance, on 30 April 2013, during a dedicated walk of 200 m along the beach inside Bautino Bay from Bautino Shagala Hotel (44°33'11.6"N 50°14'58.0"E) southwards, one of us (OSGP) counted 17 individuals, mostly adults. One of the individuals (Figure 10), in a

Figure 8. Adult *Natrix tessellata* swimming in proximity to DC 05 Island. Photograph taken from the Caspian Maria vessel by Vyacheslav Mishenko in June 2014.

Figure 9. Biotope of *Natrix tessellata* at Bautino Bay along the Kazakh sector of the northern Caspian Sea. Photograph by O. S. G. Pauwels in April 2013.

similar manner to the one shown in Figure 4, feigned death when handled, lying on its back, opening its mouth and protruding its tongue, a well-known defense mechanism in the Dice snake (Golubović et al., 2019). In April 2014 OSGP also observed two adult individuals on the beach of Akku Hotel (44°30'43.7"N, 50°14'33.5"E; see Figure 11), West of Fort Shevchenko.

A survey of three hours by OSGP during the sunny afternoon of 26 April 2013 on the beach of Aktau (Figure 12), rocky and nearly devoid of any vegetation, on the mainland of the north-eastern Caspian Sea revealed four individuals of *Natrix tessellata* (Figure 13).

Although we observed *Natrix tessellata* actively foraging in the water along the rocky shores of D Island and other islands in search of fish, no predation was documented, but several feeding observations were made in nearby coastal areas. On 6 August 2007 FAS observed an adult Dice snake preying on a *Neogobius melanostomus* (Pallas, 1814) on a beach (43°26'49.5"N, 51°18'52.2"E) located about 25 km south of Aktau (Figure 14). On the same beach on 26 August 2008 FAS photographed an adult individual swallowing a *Neogobius caspius* (von Eichwald, 1831) (Figure 15). On 25 May 2012 SU photographed an adult preying on an adult male Monkey goby *Neogobius fluviatilis* (Pallas, 1814) (Gobiidae) in breeding colors along the pier in Karazhanbas (extending from 45°11'49.63"N, 51°15'34.45"E to 45°11'59.8"N, 51°14'53.0"E) in Buzachi Peninsula (Figure 16).

That same day, walking along the same pier, SU counted a

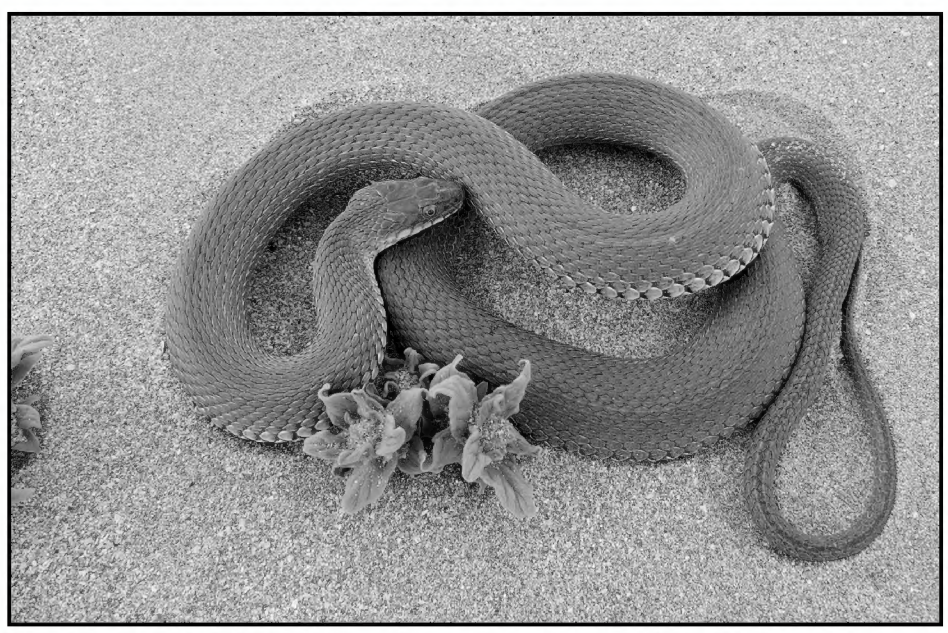

Figure 11. Adult *Natrix tessellata* on the beach West of Fort Shevchenko, Mangystau Oblast, Kazakhstan. Photograph by O. S. G. Pauwels in April 2014.

Figure 10. Subadult *Natrix tessellata* feigning death in Bautino Bay, Mangystau Oblast, Kazakhstan. Note the open mouth and the protruding, immobile, tongue. Photograph by O. S. G. Pauwels in April 2013.

total of near 2000 Dice snakes basking and foraging for fish along both rocky sides of the one-kilometer-long section of the pier penetrating into the sea (Figure 17). SU counted slightly more than 1000 on one side, and between 950 and 1000 on the other, i.e., both sides of the pier combined, there was about one individual every meter. A snake survey by FAS along both sides of the same pier on 14 October 2011, thus in autumn, had given a total, both sides of the pier combined, of only 265 individuals.

OSGP observed an adult individual catching an adult Round goby *Neogobius melanostomus* in Bautino in April 2013. Both *Neogobius fluviatilis* and *N. melanostomus* have already been recorded in the diet of the Dice snake in several other countries (Weiperth, Potyó and Puky, 2014); *N. caspius*, endemic to the Caspian sea, seems to represent an addition to its known prey spectrum. An adult Dice snake was observed near Atyrau preying on a Goldfish (Cyprinidae: *Carassius auratus* (Linnaeus, 1758)) (Figure 18), an established exotic fish species already known to be part of the prey spectrum of *Natrix tessellata* (Weiperth, Potyó and Puky, 2014).

In an evaporation pond (47°06'13.2"N, 51°59'50.4"E) of a waste treatment plant in the eastern suburbs of Atyrau, VK photographed on 20 June 2016 a large adult Dice snake preying on an adult Laughing frog *Pelophylax ridibundus* (Pallas, 1771) (Figure 19). This frog species is already known to be part of the diet of the Dice snake, although only few records exist (Weiperth, Potyó and Puky, 2014). VK documented *Natrix natrix scutata* in syntopy with *N. tessellata* in this same evaporation pond.

Figure 12. Biotope of *Natrix tessellata* on the beach of Aktau. Photograph by O. S. G. Pauwels in April 2013.

Figure 13. Subadult *Natrix tessellata* on the beach of Aktau in April 2013. Photograph by O. S. G. Pauwels. This individual showed a complete original tail with 61 divided subcaudals.

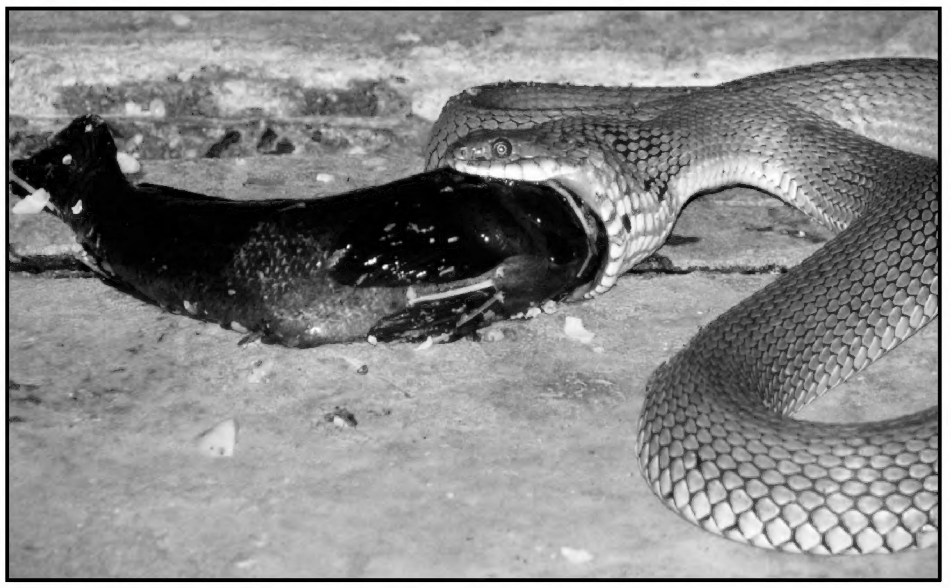

Figure 14. Adult *Natrix tessellata* preying on a *Neogobius melanostomus* near Aktau, Mangystau Oblast, Kazakhstan. Photograph by F. A. Sarayev in August 2007.

Figure 15. Adult *Natrix tessellata* eating a *Neogobius caspius* near Aktau. Photograph by F. A. Sarayev in August 2008.

Figure 16. Adult *Natrix tessellata* preying on a Monkey goby *Neogobius fluviatilis* in Karazhanbas, Mangystau Oblast, Kazakhstan. Note the yellow margins on the unpaired fins of the goby, typical for the breeding males. Photograph by S. Ukhov in May 2012.

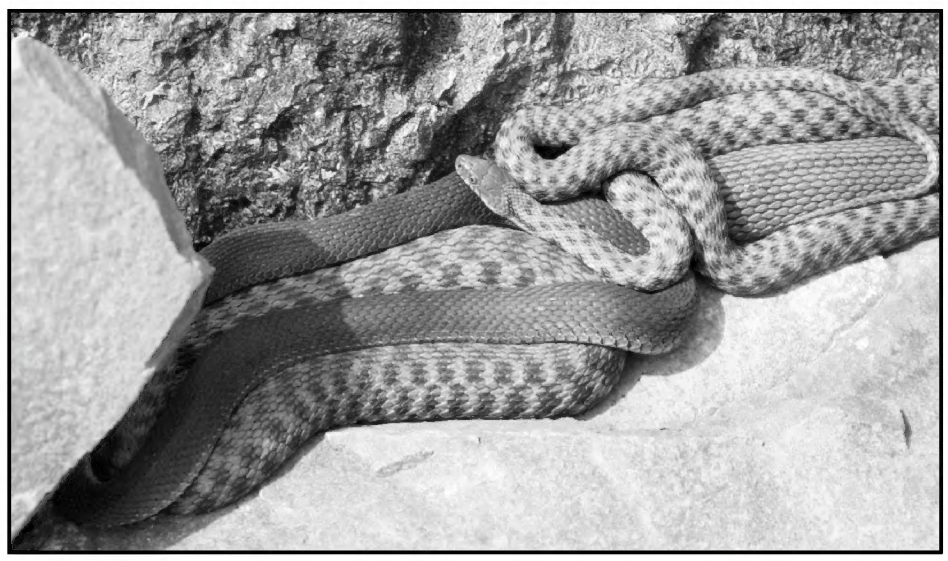

Figure 17. Four individuals of *Natrix tessellata* on Karazhanbas Pier, Mangystau Oblast, Kazakhstan. Photograph by S. Ukhov in May 2012. Note the three different color patterns in strict syntopy: checkered, gray and black.

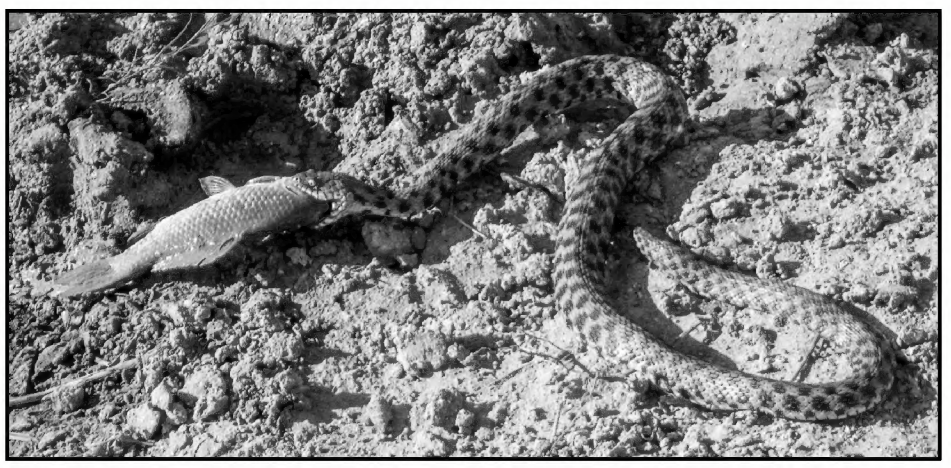

Figure 18. Adult *Natrix tessellata* consuming a Goldfish *Carassius auratus* along the Chernaya Rechka (47°07'08.6"N, 51°43'50.2"E) near Atyrau, Atyrau Oblast, Kazakhstan. Photograph by Mark Crowther in September 2014.

Figure 19. Adult *Natrix tessellata* catching an adult Laughing frog *Pelophylax ridibundus* near Atyrau, Atyrau Oblast, Kazakhstan. Photograph by V. Kovshar in June 2016.

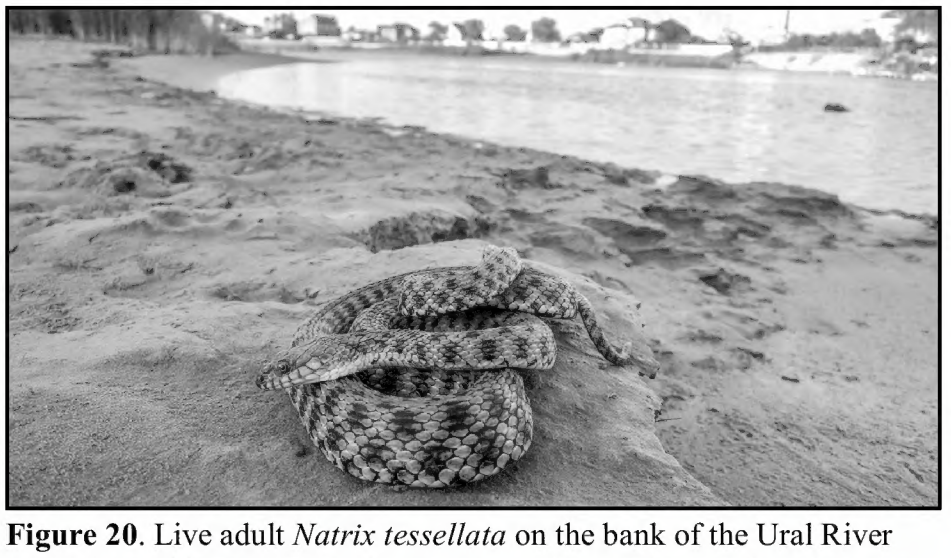

Figure 20. Live adult *Natrix tessellata* on the bank of the Ural River (47°06'47.9"N, 51°55'15.7"E) in Atyrau. The snakes are found on the open banks and among rocks rather than among the reeds. Photograph by O. S. G. Pauwels in August 2013.

Figure 21. Biotope of *Natrix natrix scutata*, *Emys orbicularis* and *Pelophylax ridibundus* in Peshnoy (46°54'09.4"N, 51°40'25.3"E), Ural Delta, Atyrau Oblast, Kazakhstan. Photograph by O. S. G. Pauwels in September 2011.

Figure 22. Live juvenile *Natrix natrix scutata* in Peshnoy (46°54'09.4"N, 51°40'25.3"E), Ural Delta, Atyrau Oblast, Kazakhstan. Photograph by O. S. G. Pauwels in September 2011.

Discussion

Our records are the first of this species for the recently built artificial islands in the Kazakh sector of the Caspian Sea. The minimal distance between the mainland and the Kazakh islands where we recorded the Dice snake is about 50 km. In the Azerbaijan sector of the Caspian Sea, *Natrix tessellata* has colonized abandoned oil drilling platforms at not more than 8–9 km from the mainland (Tuniyev et al., 2011).

Analyzing the construction design of the islands, it appears possible that snakes were included in the loads of limestone boulders used to build the islands, thus at the earliest phase of their construction. The rocks were first extracted from a quarry at Fort Shevchenko, then from a quarry in Atash, the latter quarry being taken in production since September 1998 (Granneman and Goris, 2001). Both quarries are located in the direct vicinity of the Bautino harbor (44°32'41.0"N, 50°14'47.0"E), where the rocks were stored before being sent by boats to the islands. Our observations of Dice snake individuals in the open sea suggests that the species could also have colonized the artificial islands through active swimming, without human intervention.

The most common dorsal color pattern for northern Caspian Dice snake populations is checkered (Figures 4–6, 8, 10, 13, 15–18, 20), but gray (Figures 7, 14, 17) and black (Figures 11 and 17) individuals are found in smaller numbers. The three patterns are known to co-exist in the species (Atjić et al., 2013), including in strict syntopy as shown on Figure 17.

Natrix tessellata is the only reptile species observed so far on the Kazakh artificial islands, with one notable exception. A single individual of *Emys orbicularis* (Linnaeus, 1758), a terrapin species commonly found in the Ural Delta, was photographed by Y. Bokov on EPC 04 in late August 2016 while it was basking on rocks. The photograph was unfortunately not preserved, but before deletion it had been shown to FAS, who unambiguously identified it.

The bare and rocky biotope found on the artificial islands is similar to the biotopes where Dice snakes are found on the beaches and river banks on the mainland, for example in Aktau (Figures 12 and 13) and in Atyrau (Figure 20). The other aquatic snake species that occurs together with *Natrix tessellata* in the lower Ural and its delta, *Natrix natrix scutata*, was not observed on or near these islands.

Within the Ural Delta, *Natrix natrix scutata* is generally found in sites with dense vegetation (Figures 21–24). It is easy to envision that individuals of *Natrix natrix scutata* may have reached the islands, but in the near-total absence of vegetation, in the absence of any other food resources than saltwater fishes and in competition with *N. tessellata*, they probably had no chances to establish. When comparing *Natrix natrix* and *N.*

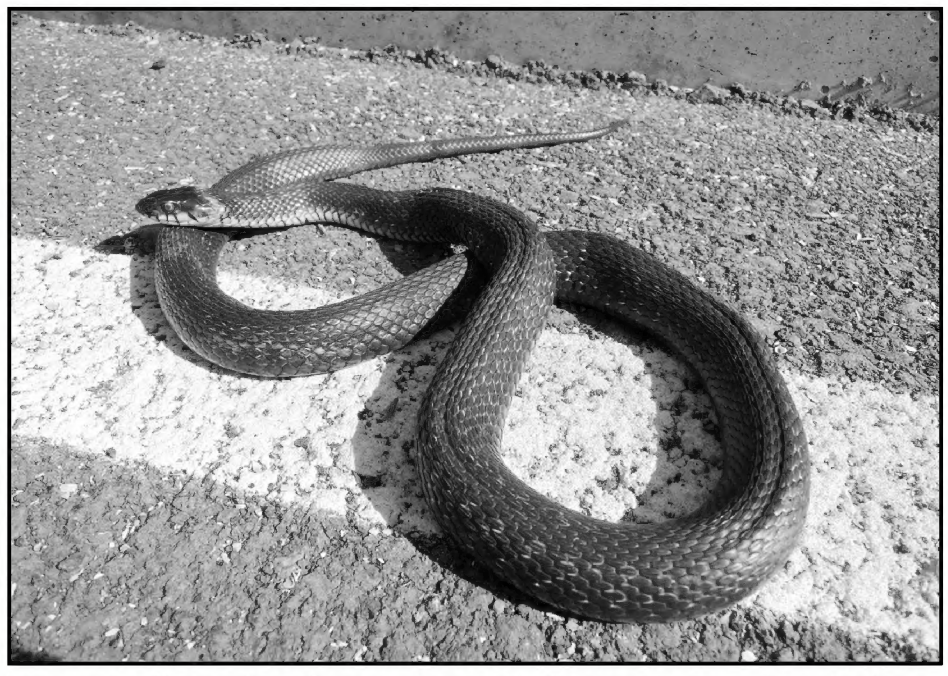

Figure 23. Laterodorsal view of an adult *Natrix natrix scutata* dead on a road (46°55'31.5"N, 51°42'20.2"E) between Damba village and Peshnoy Base, Atyrau Oblast, Kazakhstan. This individual showed 2 preventrals + 177 ventrals, a divided anal, and 1 divided + 4 single + 52 divided subcaudals. Photograph *in situ* by O. S. G. Pauwels in August 2013.

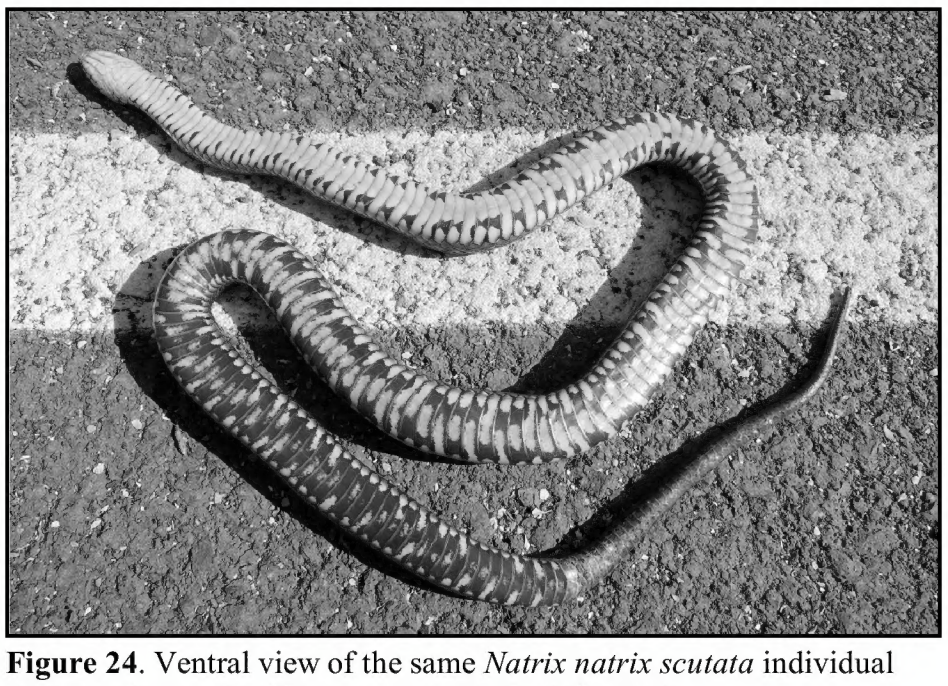

Figure 24. Ventral view of the same *Natrix natrix scutata* individual shown in Figure 23. Photograph by O. S. G. Pauwels.

tessellata sharing a site, the latter is indeed much more aquatic and specialized in predation on fish, and more able to live in bare, rocky environments and brackish water (see among others Filippi et al., 1996; Weiperth, Gaebele et al., 2014). *Natrix tessellata* is able to consume fish from birth and for life (Filippi et al., 1996; Ioannidis and Mebert, 2011). The artificial islands do not offer food resources and ecological conditions for the other snake species recorded from the northern Caspian coast (see Diarov et al., 2008, and Sarayev and Pestov, 2010).

The aquatic frog *Pelophylax ridibundus*, whose type-locality was restricted to ''Gurjew, Nord Küste des Kaspischen Meeres'' (thus Atyrau) by Mertens and Müller (1928), is abundant in the Ural Delta, but absent from the islands, as are all the amphibian species recorded from the northern coast of the Caspian Sea (see Diarov et al., 2008).

Potential predators of Dice snakes on the islands include the exotic invasive Raccoon dogs (*Nyctereutes procyonoides* (Gray, 1834)). Raccoon dogs are known to prey on *Natrix tessellata* (see among others Musilová and Zavadil, 2011). They hibernate during at least a part of the winter, but occasionally drift to islands on ice floes in the spring. For instance, on 6 May 2014 we photographed an adult individual on an ice barrier of DC 05; it was observed foraging among rocks; we trapped it and released it on the mainland. Steppe wolves *Canis lupus campestris* Dwigubski, 1804 reach the islands in the winter by walking on the frozen sea, in search of Caspian seal pups (Wilson et al., 2017), and occasionally isolated individuals do not return in time to the mainland when ice melts, but the few individuals stuck on the islands were caught and released on the mainland before the snakes emerged from hibernation. Other potential local predators include among others the Black-headed gull *Chroicocephalus ridibundus* (Linnaeus, 1766) and the Caspian gull *Larus cachinnans* Pallas, 1811, reported in other parts of their range to prey upon *Natrix tessellata* (Jelić and Lauš, 2011), and possibly the Short-eared owl *Asio flammeus* (Pontoppidan, 1763) (Strigidae), recorded by us on the islands in direct proximity of the snakes, and known to occasionally prey on squamates (Cramp, 1985).

The finding of Dice snakes of all age classes, including juveniles, indicates that they are reproducing on the islands. Although not yet confirmed from all artificial islands of the northern Caspian Sea, given their colonization potential, there is no doubt that they will be eventually found on all.

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Historical Reports of Mudpuppies (*Necturus maculosus*) from Wisconsin Newspapers: Fake News or Valuable Insights?

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OREGON ALL UPSET!
Alligator Captured In the Creek by School Children—Is It a Mud-Puppy?
—Wisconsin State Journal headline (10 October 1901)

Introduction

Amphibians and reptiles often attract the attention of and are of interest to the general public. As such, newspapers occasionally report on chance encounters with these animals, unusual life history attributes of particular species, or other aspects that reporters and editors believe may interest their readership. Such accounts can provide interesting insights into the relationships between people and the wildlife they encounter, and information gleaned from newspapers can supplement museum collections and the technical literature to provide a more nuanced understanding of species' natural history and human-wildlife interactions. For example, a good deal of what we know about the geographic distribution, relative abundance, and utilization of wildlife in early Wisconsin following Euro-American settlement comes from the careful compilation and analysis of information found in contemporaneous newspaper accounts (e.g., Schorger, 1942, 1949a, 1949b, 1965, 1967–1968). Newspaper reports may provide the only documented historical anecdotes available for some species. In a few instances, photographs of newspaper accounts have even been used as "vouchers" to document new county records (e.g., Casper's [1996] record for La Crosse County, Wisconsin; Figure 1), even though such reports may not meet scientific standards for confirmation (Casper et. al., 2015).

Today, recently developed optical character recognition technologies provide the opportunity to search electronic archives of newspapers and compile species observations from large geographic areas over many years. For example, the online database NewspaperARCHIVE.com is searchable and includes millions of newspaper pages dating from 1607 to the present. I recently explored NewspaperARCHIVE.com to find historical reports of mudpuppies (*Necturus maculosus*) in Wisconsin. Search terms included common names (e.g., mudpuppy, mudpuppies, mud puppy, mud-puppy, water dog, water puppy, necturus, proteus) constrained by relevant parameters (e.g., geographically to Wisconsin, temporally to decades prior to 2000). These queries produced more than 10,000 "hits" that fit various combinations of the search parameters. Many results were unrelated to *N. maculosus*, instead referring to a popular "mud puppy" fishing lure or to a Mudpuppy Lake, or having some other tangential connection to the search terms. Yet, numerous records did refer to articles mentioning this animal. A selection of some of the more noteworthy reports are discussed here and are placed in the context of museum specimens and records from the scientific literature.

ON THE WILD SIDE La Crosse Tribune

Angler catches big mud puppy

Deer hunters discover unusual critters. Anglers do, too.

Lloyd Newman, La Crosse, caught a 15-inch mud puppy in the Black River recently. Newman was fishing for catfish with chicken liver. He took the salamander-like animal to the National Biological Survey Laboratory on French Island to be identified.

"I've been fishing 40 years and never caught one before," Newman said.

The Newmans are keeping the aquatic, legged animal alive in an aquarium, where it can use its external gills to get oxygen from the water. Mud puppies usually don't get as large as the one Newman caught.

Elsewhere:

■ John Williams of La Crosse shot a young pie-bald buck south of Coon Valley in Management Unit 24A opening weekend.

"I saw the deer in the morning and let it go by," Williams said. "But when he came back in the afternoon I shot him."

The face, hooves and lower legs of the deer were white. Pie bald deer, unlike albino deer are legal game in Wisconsin.

A former commander at Fort McCoy discouraged shooting pie bald deer, but that restriction no longer exists. Several other pie-bald deer have been shot recently between Coon Valley and Chaseburg, according to Roger Anderson, La Crosse DNR technician.

■ Ron Kendhammer of La Crosse discovered a dead buck wedged between three trees on some private property near Warrens in early November. The 5-point buck apparently got his head lodged between the trees and couldn't pull it out.

■ A Fort McCoy buck had to be shot by wardens after it got tangled in a parachute. The deer carried the parachute and canister several weeks before being shot.

■ Gerald Shepard of Shep's Taxidermy reported that a hunter brought a 6½-year-old buck to be mounted.

Jerry Davis photo

MUD PUPPY: Lloyd Newman of French Island caught this 15-inch salamander-like amphibian from the Black River recently.

Figure 1. Milwaukee Public Museum voucher photo VZP531c, the basis for Casper's (1996) county record from La Crosse County, Wisconsin.

Selected Newspaper Accounts

St. Croix River – Niskanen (1996) chronicled a day of ice fishing "mishaps" on the St. Croix River. "Oh my god, it's a horrible, disgusting MUD PUPPY! I can't stand these slimy things. We're doomed. They're bad luck, and we'll never catch another fish." Despite the apparent alarm, the author went on to note that those mudpuppies were "real wall hangers," measuring 8 to 12 inches long.

Menominee River – Anonymous (1930) mentioned that an 11-inch mudpuppy caught at White Rapids (Marinette County) was placed on display upstream in a Norway storefront, and another newspaper story (Bachay, 1966a) told of an angler catching a mudpuppy along the Wisconsin side of the Menomonee River in March 1966. These reports significantly predate Casper's (1996) documentation of the species in Marinette County with voucher specimens, and Watermolen's (1996) report of osprey (*Pandion haliaetus*) predation on mudpuppies in the lower stretches of the river.

Wolf River – Anonymous (1964) claimed, "Any Wolf River fisherman can tell you about these slimy pests. They steal bait and get twisted up on the line . . . They've been known to permanently sour delicate ladies, old and young, on the sport of fishing." In discussing mudpuppies in Green Lake (Green Lake County), Anonymous (1964) further commented that, "They usually feed at night, mostly on mollusks, aquatic insects, earthworms, cray fish, small fish and frogs, and presumably in the Wolf River the eggs of game fish, although no studies have been made of this to the best of my knowledge." The writer was apparently unaware of the dietary studies undertaken by Hamil-

ton (1932) and Lagler and Goellner (1941).

Lake Butte des Morts – Cahn and Shumway (1926) mentioned two albino mudpuppy larvae that they had raised in a Waukesha laboratory without specifying a source or collection location for the specimens. Later, in an interesting newspaper account, Anonymous (1940) discussed an albino mudpuppy that was collected along with "a batch of these lizard like-creatures" trapped in Lake Butte des Morts (Winnebago County). According to the article, the Museum of Natural History in New York City was interested in the mudpuppies "because they are believed to be the larval stage of some now extinct form of life that roamed the world possibly a million years ago." The albino specimen measured "about 15 inches long and weighed about a pound." The article also mentioned that the collector had been wholesaling "frogs and necturus" for over 20 years, selling specimens "to museums of natural history throughout the United States for scientific study." Hutt (1945) later reported albino specimens in the scientific literature.

Lake Michigan, including Green Bay and Sturgeon Bay – Mudpuppies have long been known from Lake Michigan (Hoy, 1882; Yarrow, 1882). Suzuki (1951) reported specimens from near Sturgeon Bay (Door County), Dykesville (Kewaunee County), and Two Rivers (Manitowoc County). Reigle's (1967) records from deep waters came from Green Bay not far from Sturgeon Bay. Numerous newspaper reports supplement these records. Richards (1964) recounted how his catch of the night was a mudpuppy during the annual smelt (*Osmerus mordax*) run near Manitowoc (Manitowoc County). According to newspaper accounts, prizes were awarded for the largest mudpuppy caught during the annual ice fishing jamborees held on Green Bay near Brussels (Door County; Anonymous, 1953; Herman, 1954, 1956, 1957). Anonymous (1966) commented that the eggs of Lake Michigan whitefish "are often preyed upon by various fishes and mudpuppies."

Suamico / Suamico River – Anonymous (1934a, 1934b) told a story about a mudpuppy collected at Suamico (Brown County) and maintained in captivity at the Stangel Hardware Company. The mudpuppy "found an open clam and commenced eating. The clam, rightfully indignant, closed itself over the mud puppy's nose. Shake and wriggle as he would the mud puppy couldn't part company with his prospective dinner." The collector took the two organisms to Manitowoc where "The mud puppy gave up hope yesterday and died. The clam is still as mad as ever, though he refuses to release his hold" (Anonymous, 1934a). More than 40 years later, Reed and Hodgson (1987) reported the first vouchered record from the Suamico River near the west shore of Green Bay. Wisconsin Department of Natural Resources staff also collected a specimen (MPM 13825) from the Suamico River in October 1975.

West Twin River and Silver Creek – Suzuki (1951) reported mudpuppies from Two Rivers (Manitowoc County). Not long after, a short note in the *Manitowoc Herald Times* (Herman, 1955) made mention of "how many mudpuppies are showing up in the West Twin River." The author suggested that "universities are buying the critters for some experimental work and will buy all they can get a hold of, paying up to 35 cents a piece for them." Anonymous (1929) mentioned a mudpuppy being caught on nearby Silver Creek.

Grand River / Grand River Marsh – Anonymous (1975) mentioned that mudpuppies occurred in the project area for the Grand River Marsh State Wildlife Area (Marquette and Green Lake counties) that was developed in the 1970s.

Green Lake – Mudpuppies have long been known to occur in Green Lake (Green Lake County; Pope, 1930). During the early and mid-1950s, the Wisconsin Conservation Department undertook significant efforts to develop a reproducing population of the introduced lake trout (*Salvelinus namaycush*) in Green Lake. The efforts of fisheries biologist Vern Hacker were particularly noteworthy (Anonymous, 1958c; Hacker, 1957; Westover 1962). Hacker (1957) found lake trout eggs in 70 percent of the mudpuppies that he trapped over artificial fish spawning structures in the lake and attributed the lack of reproduction by this introduced fish to mudpuppy predation on their eggs. Hacker's findings received considerable media attention and the resulting commentary often fueled the idea that mudpuppies are destructive to sport fisheries. For example, Pyre (1954a) reported that "a large mud puppy population is destructive of lake trout eggs spawned on the principal bar extending into the lake." Westover (1962) wrote "after 175 days they hatch—if the mud puppies haven't eaten them before they get a chance . . . A batch of trout eggs is just caviar to a mud puppy. Without protection on the mud bottom where the stupid trout persisted in laying their eggs, the entire batch is doomed to be consumed in about 30 days."

Some newspaper accounts described the efforts Hacker's team made to reduce the effects of predation. For example, Anonymous (1956) related that, "An experiment was tried. Large wooden trays loaded with rocks were lowered. Later, the trays were pulled up. The trout eggs were still there, untouched by the mud puppies." Further, in Anonymous' (1958a) report of SCUBA investigations, it was noted that "During a three-hour investigation, no mud puppies were spotted near the spawning area." In another example, Anonymous (1958c) explained, "To confound them 280 tons of granite were dumped on the ice in winter. The ice melted in the spring. The lakers spawned in the fall and the eggs hid in the rocky crevices." The placement of rocky substrates over the lake bottom provided protective cover for the fish eggs and fry allowing for successful trout reproduction and recruitment (Hacker, 1957). Some writers, however, apparently misunderstood the success of this approach. For example, Anonymous (1964) noted that "In lakes like Big Green, where lake trout reproduce, mud puppies prove a threat to the lake trout eggs which are laid in the rocky crevices in which mud puppies frequent."

Other accounts from Green Lake simply report anglers' incidental catches. For example, Dunn (1962) related a story about a group of anglers who fished Green Lake in early 1962: "Four mud puppies represented their total bag for the day." Harp (1968) relayed a similar experience, reporting that he and two friends caught 19 mudpuppies in their shanties and noting "most of the other fisherman in the 14-man group also reported activity from mud puppies." Bachay's (1966a) report of a Green Lake outing included a photograph of an 11.5-inch-long mudpuppy that an angler had given him. Watermolen (2018) discussed more recent mudpuppy records from Green Lake.

Wisconsin River – Mudpuppies have been reported from various locales along the Wisconsin River. A front-page story in the *Madison Capital Times* (Anonymous, 1931) included a photograph of a mudpuppy caught in the Wisconsin River near Spring Green (Sauk County). The animal was placed on display at a Madison electrician's shop. This report supplements Cochran and Lyons' (1986) mention of mudpuppies being caught in the river downstream in Richland and Crawford counties. Much farther upstream, Rhinelander (Oneida County) is listed as the collection locality for a series of 11 larval specimens collected in May 1950 and now housed in the University of California-Berkley's Museum of Vertebrate Zoology (MVZ 52646-52656). Although the collection information does not include a specific waterbody name, these specimens were most likely collected in the Wisconsin River.

Lake Mendota, Lake Monona and Lake Waubesa – Mudpuppies have long been known to occur in the Madison-area chain of lakes (Dane County; Smith, 1911; Vogt, 1981). An early newspaper account of mudpuppies in Wisconsin (Anonymous, 1916) briefly discussed an exhibit of "four savage mud-puppies" in the Biology building on the University of Wisconsin campus. The article noted that "To the layman the mud-puppy looks like a Burbank cross between a snake and a piece of beef steak, but the scientific men announce that it is a 'perennibranchiate species of salamander,' common in Lake Mendota and perfectly harmless" (Anonymous, 1916). Pyre (1954b) related how two graduate students reported observing "200 or more mud puppies" in shallow waters adjacent the University campus in December 1954. The article further noted, "It has been common belief among Madison cisco dippers that the mud puppies, which are members of the salamander family, come inshore at this season to feed on whitefish spawn." It then pointed out, "The real dope is that they too come inshore to mate at this season although the females do not lay their eggs until spring." Interestingly, Vogt (1981, p. 58) cited Pearse (1921) as finding "whitefish" eggs in the stomachs of Lake Mendota mudpuppies, apparently misinterpreting Pearse's (1921) quote of Milner's (1874) work in Michigan. Whitefish (*Coregonus clupeaformis*) are not native to Lake Mendota (Lathrop et al., 1992), however, and Cochran (1986) suggested that ciscoes (*Coregonus artedii*) were more likely the intended target of this reference. Bachay (1954) relayed an anecdote from a Lake Mendota angler who caught an 8-inch-long mudpuppy while fishing for yellow perch (*Perca flavescens*) "on the bottom in 30 feet of water." He went on to comment, "If you want an interesting hobby, one that will intrigue your friends as well, why not start a study collection of preserved specimens in glass jars. The mud puppy and his cousin, the spotted salamander, are both interesting." Given their apparent abundance in Lake Mendota, it is not surprising that Vogt (1981) mentioned University of Wisconsin graduate students partaking in an annual contest to see who could catch the most mudpuppies from the lake, an endeavor that culminated in a mudpuppy fry and dinner.

In Lake Monona, Baas (1963) reported that the lake bottom at Turville Bay was "covered with" mudpuppies. His observation is similar to Smith's (1911), who found mudpuppies nesting in shallow areas (<1.5 m) of Lake Monona where the "bottom was strewn with loose flat stones of various sizes." Bachay (1978) later reported that a mudpuppy was caught in adjoining Lake Waubesa with a minnow bait.

Figure 2. Badfish Creek near Cooksville, Rock County, Wisconsin, 16 February 2018. Photo courtesy of the U.S. Geological Survey.

Yahara River and Rock River – Bachay (1975) reported an 8-inch-long mudpuppy being caught by an angler fishing on the Yahara River below the Fulton dam (Rock County). A mudpuppy taken by an angler from the Rock River at the Four Mile bridge (Janesville, Rock County) was supposedly "the largest ever reported caught in this territory" (Anonymous, 1935). However, that record did not stand. Anonymous (1958b) related how an angler "got the surprise of his life Friday while fishing in the Rock River at Riverside Park." That angler's mudpuppy catch measured 15 inches long "and weighed 1 7/8 pounds." The earlier article characterized mudpuppies as "uncommon in waters of Wisconsin" (Anonymous, 1935). Bachay (1976b) also reported mudpuppies, including a 13-inch-long specimen, being caught by anglers on the Rock River. These reports predate by many years Casper's (1996) vouchered record for this county.

Badfish Creek – In one of the earliest mentions of a mudpuppy in the state, the *Wisconsin State Journal* reported that a group of school children had captured an alligator "in Badfish Creek [Dane and Rock counties] just below downtown" (Anonymous, 1901). The animal was placed "in a box" and put on exhibition at McGill's blacksmith shop, where it was fed a "lump of sugar and molasses cookies." The article concluded with, "A university expert said this afternoon the alligator is probably a mudpuppy." It would be interesting to investigate whether mudpuppies occur in Badfish Creek today. Two municipal sewerage treatment plants have discharged to the stream since the 1950s, and nearly 100 percent of the creek's length in Dane County has been ditched, straightened, and widened (Ball et al., 1970; Day et al., 1985). The stream's natural morphology, however, has been preserved in the lower stretches in Rock County (Figure 2). In the 1970s, the Wisconsin DNR considered water quality in the creek to be impaired due to nutrients from the sewage treatment plant effluent (Ball et al., 1970). Advancements in treatment capabilities and more stringent permit conditions, however, resulted in water quality improvements in the 1990s and 2000s (Wisconsin DNR, 2020). Today, available biological data do not indicate impairment, but the fishery is dominated by forage and rough species and there remains a legacy of PCB-contaminated sediments.

Sugar River – Bachay (1976a) reported that an angler had

caught a mudpuppy using "carp guts as bait" while fishing for catfish (*Ictalurus* sp.) on the Sugar River (Green County). To date, voucher specimens have not been collected in this area.

Lake Geneva – Some of the earliest collections of Wisconsin mudpuppies are from Lake Geneva (Walworth County; Yarrow, 1882). Bachay (1958a, 1958b) mentioned that anglers would sometimes catch mudpuppies through the ice while fishing for yellow perch in Lake Geneva, and later (Bachay 1978) stated that mudpuppies were common in this lake. In writing about smallmouth bass (*Micropterus dolomieu*) population fluctuations in Lake Geneva, Bachay (1961) claimed, "Some even blamed bullheads for eating the spawn, while mudpuppies really are the culprits."

Silver Lake – The Kenosha County Conservation Club sponsored an Ice Derby on Silver Lake in January 1959 (Anonymous, 1959). Two winners claimed prizes in the "oddest fish" category. Both caught mudpuppies!

Discussion and Conclusions

While not generally viewed as sources of scientific information, newspaper reports provide potentially useful information for better understanding a species' historical occurrence. Given the mudpuppy's near statewide distribution (Watermolen, 2015, 2018), it is not surprising to find accounts of this species in newspapers from around the state. Accounts from previously unvouchered areas provide suggestions of where to look in future survey efforts.

Curiosities often make for good news stories. As a result, newspapers have sometimes been the first sources to publish interesting natural history observations. For example, reports of the albino mudpuppies reported from Lake Butte des Morts first appeared in the popular press (Anonymous, 1940). Similarly, my recent search of NewspaperARCHIVE.com revealed that 26 years prior to my report of a case of attempted osprey predation on a mudpuppy (Watermolen, 1996), an edition of the *Rhinelander Daily News* featured a photograph of an osprey carrying a mudpuppy "home to be eaten" (Anonymous, 1970).

Popular press accounts provide insights into contemporaneous attitudes regarding wildlife. References to common and easily recognized species, species thought to be more charismatic, and species with economic value can be expected to turn up with more frequency. Most newspaper references to mudpuppies are anecdotal accounts from anglers who unexpectedly caught the otherwise secretive salamander on their fishing line, often while ice fishing. Some articles mention prizes awarded for the largest mudpuppies caught during fishing tournaments (e.g., Anonymous, 1953; Herman, 1956). Other reports reflect a level of disdain for the "slimy" creature (e.g., Anonymous, 1964; Niskanen, 1966). Still other accounts underscore the perceived value of mudpuppies for scientific work (e.g., Anonymous, 1940; Herman, 1955).

Of course, popular media accounts are not without limitations. The validity of anecdotal, and often second hand, reports must be considered cautiously. References to mudpuppies may actually refer to other species. For example, an article in the *Eau Claire Leader* (Anonymous, 1908) refers to the "adult form" of "*Amblydtoma Tigrinum* [*sic*]" as "a salamander or mud puppy that is found in almost every frog pond in this country." This is clearly a reference to the tiger salamander (*Ambystoma tigrinum*) and not the mudpuppy. In another example, writing for the *Racine Journal Times*, Anonymous (1937) reported on "hundreds of mudpuppies" that invaded a man's backyard and his workshop. These animals were "from two to seven inches long. They were black on top and gray underneath." Again, this is clearly a reference to some species other than *N. maculosus*. In another example, the *Kenosha Evening News* (Anonymous, 1960) described an experimental toxaphene treatment of Bass Lake (Waupaca County) to remove rough fish. In describing the outcome, the article indicated, "Only survivors in the lake were listed by the underwater surveyors as an approximate one-third of the mud puppies (tiger salamanders) but they apparently were turning groggy after emerging from the lake bottom mud." Sometimes it is just not possible to determine what species a writer is referring to.

Researchers must be wary of "fake news," as newspapers may also be sources of unsubstantiated claims and folklore. Newspaper reports seem to be a primary source for the persistent belief that mudpuppies negatively impact game fish populations through egg predation (e.g., Pyre, 1954a; Bachay, 1961; Westover, 1962). And the superstitious narrative that mudpuppies bring bad luck persisted well into the 1990s (e.g., Niskanen, 1996).

Despite these limitations, old newspapers may be a valuable source of historical reports of species of conservation interest. They may also help explain prevailing attitudes about "less than glamorous" species. I encourage others to investigate NewspaperARCHIVE.com and similar sources and report the results of their efforts.

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Memo to the Neighborhood Roadrunners: *Leave My Yard Lizards Alone, or Else . . .*

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My working career as a tool and die maker lasted 47 years. I worked at nine different places during that time period. I was blessed in the fact that every place I worked was a good job, but there was one standout for me as being the best job ever. We speak of a place simply called TEC, located in Tucson, Arizona. I worked there from 1981 through 1987. I still dream of the place and the people who worked there. If we tool and die makers must work our craft in the afterlife, I hope it is at a place like TEC. It would sure beat the hell out of sitting on a cloud and strumming a harp. There was a crusty old Jack-of-all-trades dude I worked with at TEC whose name was Bob Barry. Bob was the closest thing to a herpetologist I had to speak with for my first six years in Tucson. This is not say that he *was* a herpetologist. Not even close. He did not "keep" herps, and he did not go out of his way to seek herps. But as a person who grew up in Arizona, he had a good general knowledge of the herps that live here. He was born and raised on the far northeast side of Tucson. His family owned vast acreage just east of the Sabino Canyon Recreation Area. His back yard abutted right against the southern edge of the Santa Catalina Mountains. The area is not "Nature's Half Acre" at all—it is more like nature's million acres. I can only imagine what it was like growing up here. Bob outlasted all his many siblings, and he was the one who wound up keeping the place. As a quick side story before the main event, Bob mentioned that he would routinely move Tiger Rattlesnakes (*Crotalus tigris*) out of his back yard. He only moved the snakes out of consideration for his dogs, and the very fact that he moved them instead of killing them reflects kindly on him. At the time, I had yet to see a tiger, and was very excited at the prospect. I asked him to bring me one sometime. Two days later, he brought me a *dandy* of a specimen, well over a meter long, and that solidified our friendship. He could do no wrong in my eyes from that day forth—until he told me his roadrunner story. While we were working together at loading an injection molding machine, he casually mentioned popping a roadrunner off his back porch wall with his .22 caliber rifle. Apparently, this was a habit of his. Like all bad habits, he tried it once—and liked it. This particular incident was more fun than most, as the shot tore the bird's head clean off. As soon as he was finished with the story, I called him a mean old man, and asked him why he would do such a thing. I'll never forget his response: "Why would I do this? Why do you think, dumbass? Because the blankety-blank things are eating all my lizards! You of all people should understand this." With Bob's words still ringing in my ears today, we move on with the narrative.

Figure 1. Greater Roadrunner (*Geococcyx californianus*) with a headless Western Whiptail (*Aspidoscelis tigris*) in its beak. The author is also losing his head over this otherwise charismatic bird wiping out his yard lizards. He has become proactively militant toward the problem. See text for details. Image by R. C. Clark, Dancing Snake Nature Photography.

The event about to be described happened on the afternoon of 11 October 2019. My Swiss friends Urs Brunner and Heide Riesen-Steffen were along for what we had learned to call "a rough and wild truck tour." Before going any further in the narrative, we back up enough to say that Urs and Heidi were visiting Arizona from Switzerland. When Swiss people vacation, they don't mess around! In 2019, Urs and Heidi arrived in August and stayed until late October. I would normally be tired of *any* visitors—foreign or otherwise—after 12 minutes. But Urs and Heidi stayed for 12 weeks! They are such a lovable couple that the 12 weeks passed all too quickly, and I was sincerely sad and sorry to see them go. While both are on the other side of 70, they are young at heart. Urs loves all manner of herps, and when at home, often assists with studies on the local vipers. Heidi is always game for anything, and their ability to view the world as though looking at it through the eyes of a child guarantees a good time for all—even grumpy Americans. Their love of Arizona in general, and the saguaro cactus in particular, always serves to rekindle my own love of the same. Their wide-eyed exuberance and enthusiasm is further enhanced by Urs's ability to string together his own version of English. Even routine discussions take on colorful hues when Urs does the talking. He has no fear of saying something incorrectly. He just plows ahead at full speed and conveys his message in a unique and artful fashion. For example, it was he who created the term "rough and wild truck tour" for these truck excursions. Only with him saying it, the notion was expressed as "r-r-r-r-r-uf und vild." He pegged it nicely. The notion behind these adventures was to use the good paved roads to get as far out of town as possible. We would then take dirt roads and jeep trails, some of which wound through treacherous and mountainous terrain, all the way back to Tucson.

On this particular day, we had just left pavement, and were barreling eastward on a rather wide and well-graded gravel road. The sun was at our backs, highlighting every aspect of that which was ahead as we blazed toward our goal of ever less-traveled southbound roads. I was driving much too fast, as is my wont, when our eyes picked off some movement on the left side of the road. We were about 50 meters away when we first no-

ticed it, but we were closing in fast. I had already started to apply the brakes as the object came in focus. It was a low-flying Greater Roadrunner (*Geococcyx californianus*). When we first saw it, the bird had its wings spread open wide, its long legs tucked upward against its chest, and its head with impossibly long beak stretched straight out in front of it. It skimmed over the top of the knee-high sandy berm of the road. It was flying so low that the curled toes of the bird actually knocked some dirt loose while passing over top. Without pause, the wings folded inward, the body and head went erect, and the legs straightened up to connect with the road. By this point in time, my truck had come to a stop, and we were roughly five meters away from what came next. As suggested by its name, our roadrunner hit the road running, without losing any momentum whatsoever. It went from flight to a sprint, and crossed in front of the truck. Without missing a beat, it dipped its beak to the road at mid-point of the truck, and snatched something off the surface. It continued onward, off the road and out of sight. It was a "bang-bang" observation—one that happened so fast that my eyes couldn't detect exactly what had just happened.

Guessing wildly, I said "I think it just got a whiptail." But two quick "No, it ish der schnake—und it is over here now," were uttered in simultaneous rebuttal from my passengers. Sure enough, they were pointing to something beyond the right berm of the road. When we all got out to investigate, we saw a young-of-the-year Sonoran Gophersnake (*Pituophis catenifer*) writhing on top of a cholla ball. Whether the *nasty* bird had deliberately placed it there with thoughts of returning later to claim it, or it had just landed there when dropped in haste, this poor little snake was in a world of hurt. The needle-sharp spines that bristled in all directions from the pernicious plant-part had run it through in several places. And the more that it twisted in agony, the more it was getting stuck. To say that this stunned little snake wasn't having a good day would be an understatement, and we didn't exactly put its uncomprehending mind at ease with our fumbling efforts to free it. We eventually managed to use my comb to get under the spines to tear the pod-of-angst free, and tweezers to pluck out the individual spines still remaining. When finally placed on the road for some photographs, this snake let it be known to us that it was not at all happy with *anything* that had just happened. It of course had no idea that we had just saved its miserable young life twice. Rather than being grateful, it instead felt inclined to be sorely vexed with us. The pugnacious way it raised its coils above the road, vibrated its tail, hissed and launched strike after strike would have been intimidating had not the diminutive size of the poor thing been so laughable. On top of everything else that had gone wrong for this snake, it also had somehow literally "bit the dust" when that bang-bang roadrunner had nailed it (Figure 2). Just prior to our releasing it to get on with its life, the tiny snake had to endure us prying its mouth open in order to rinse it out. We probably should have used soap in the process, as that snake had probably cussed us mightily!

Meanwhile, based on what we saw, I'd have to say that there were some highly-honed hunting skills used by our feathered friend here. Certainly, vision and speed played its part. We can only guess at how the roadrunner saw that snake crossing the road, and how far from that snake it was when it did. It only makes sense that the goofy-looking thing was eyeing that snake from somewhere above the road. (It obviously could not see the snake if it were below the road). I have dozens of observations—too many observations—of them hopping on top of something tall in order to survey everything around them. As the road we were traveling on is flanked by boulder fields, the top of any of these boulders would have been a suitable perch. I will leave any further speculation—including whether it saw us coming—out of the rest of this event. At the point where I saw the bird, it was roughly five meters away from the road, flying low and fast. From that point to where it had seized the snake and was out of sight has already been described. "Bang-bang" sums it up nicely. The way it switched from flight to running in such seamless fashion is noteworthy. We were the only fly in the ointment of what might have otherwise been a perfect stalk, chase, kill and eat effort. That big truck had to be enough of a distraction to cause it to drop its supper. Were it any other creature in the desert, I would feel guilty about being responsible for a lost meal opportunity. But a roadrunner? No so much!

As mentioned earlier, in my former life I was a full-time tool and die maker. I am now a full-time husband. Both require skill

Figure 2. (Left) A thoroughly aroused young of the year Sonoran Gophersnake (*Pituophis catenifer*) who has suffered through the indignities of an attack from a roadrunner and a painful rescue from the hands of human interlopers. (Right) Magnification of the head reveals damage to the right eye of the snake, as well as a mouthful of road gravel. Images by Roger A. Repp, 11 October 2019.

to be and remain successful, but mastering the skill sets of being a husband is much more difficult. That is especially true when the husband is by nature a lazy slug, who has zero interest in household upkeep. That sort of husband needs to develop highly-honed work-avoidance skills. It is for that reason that I keep the hinges to our side door well oiled. As soon as I see the mops and buckets come out, or a vacuum cleaner appear, out the door I go! And thanks to good old WD-40, the hinges to that door do not creak when opened or closed. If I ever *do* decide to take on a home project, it will be to design and make an invisible, husband-sized doggie door to help me escape. But the system that I have now seems to be working well enough to avoid creating a self-serving, multi-billion dollar industry such as that. Of course, if there wasn't something to do once I was outside, the whole reason for being there would be negligible. For starters, there is a comfortable bench just outside that door. It is a hefty plastic affair, with a hinged seat that opens to ample storage space. I keep all our yard tools inside said storage space, not to mention the highly territorial black widow colony that has gathered around those tools due to years of neglect. The legs that the bench stands on are stubby affairs, less than an inch tall. Hence, there is very little clearance between the bench bottom and the concrete slab on which it sits. The bench is shaded, as it resides under the canopy of our carport. Also under the shaded canopy of the carport are two vehicles. My truck is the vehicle always parked closest to the door. When I sit at that bench, there might be those who would say that I am doing nothing—as that is exactly what appears to be happening. But in reality, I am accomplishing many things at once. I am always thinking, which is a big part of the multitasking going on. But there are always many species of dead insects clinging to the front of my truck to try to identify. I also have a great, albeit narrow, view of what is happening in the meter-wide strip of driveway between my truck and house. That view stretches to the road and beyond, which allows me to watch nature, as well as spy on the neighbors. There is a great deal of both to be seen while I sit on that bench. I have recently added throwing rocks to my repertoire of things to do while sitting there and avoiding all forms of housework. It is for that reason that I always keep some hefty, palm-sized chunks of murderous basaltic volcano vomit on the seat beside me. When the proper time for hurling one or more of these at any intended target arrives, it would not be prudent to be fumbling about seeking the proper projectile.

Now would be the proper time to mention that I did *not* come out of my mother's womb hating roadrunners. And as a self-professing naturalist, I know how improper it may seem for me to express anything but a sunnyside up attitude toward any of nature's creatures—especially a creature as charismatic as the roadrunner. The Warner Brothers movie cartoons that I watched during my formative years may have left deep scars within my inner psyche. All that I wanted out of my young life was to *just once* see purple roadrunner feathers in one of Wile E. Coyote's zingers. And I know damn well that I am not alone with this desire. Even Chuck Jones, who was the artist who created the roadrunner for Warner Brothers, whipped up a meme of Wile E. Coyote with his hands around the roadrunner's throat. The caption for this joke has old Wile E. uttering "Beep beep my ass." Obviously, even Mr. Jones had had enough of that purple monstrosity of his. But no, I refuse to blame a cartoon for my problem. I arrived in Arizona *loving* these creatures. And the fact is, I still do love them. They are free to roam unchallenged and unmolested any place they want *except* for one tiny patch of this planet. I simply do *not* want the sonsabitches in my yard!

Up until just over a year ago, I harbored no ill will toward them. It wasn't until the year 2019 that I began to eye these pencil-necked geeks of the bird world with contempt. From 2003, when I first moved into my house, until 2019, I did not see a single roadrunner enter my yard. Then came that first impression. I was pulling up into my driveway, when one of the lanky feathered fiends jumped on top of the four-foot-tall cinder block wall that separates my carport from my back yard. It had a whiptail lizard stuffed halfway down its gullet, the hindquarters of which were dangling lifelessly from its beak. It hopped down from that wall, and began to dash through the narrow opening between the driver's side of my truck and the south side of our house. I was quick, but not quite quick enough. With murderous thoughts in my head, I whipped my truck door open in an attempt to clothesline the jerk. I missed—but not by much! There is still a dent in the side of my house from that effort, as well as a small piece of my backside residing in the teeth of my wife. (She is five foot nothing and I'm *terrified* of her.) As soon as that first roadrunner was spotted, the plague was unleashed. I would see one nearly every day, and the lizard population in my yard subsequently plummeted into extinction as a result. Once the lizards were gone, so was my roadrunner. This proved to me that they are little more than feathered mooches, who only came calling if there is something to be had from the visit.

In early April of 2020, an event happened that was a tune up for that which was to follow. I was witness to another predation attempt on the part of a roadrunner. The gophersnake was bang-bang, but there was only time for "bang" with this one. I was just sitting there on my bench, peacefully praying that one of the young party girls who live across the street might come out and give me an eyeful. Sadly, that didn't happen on this particular day. What *did* happen—in *far* less time that it takes to tell the story—is that a whiptail, with a roadrunner in hot pursuit, rounded the corner of my house, and both came straight at me. The distance they covered blazing straight down that opening between truck and house is roughly 20 feet, but they did so with such speed that what happened next was over before I could even react to it. The whiptail, which was a Western Whiptail (*Aspidoscelis tigris*), jetted between my legs and slipped safely under the bench. The roadrunner could not stop its momentum, freaked out, and tried to go airborne. It smacked me right in the chest and flopped into my lap. To say that this scared the bejeepers out of me would be an understatement. If I would have been one split second faster, I could have grabbed it and wrung its filthy neck. But it all took me by such surprise that I immediately stood up, and it fell to the cement at my feet. It was then that I tried to stomp on it, but it quickly dashed out of stomping range. It stopped fleeing from me when it was about ten feet away, and stood there gaping at me. They look really stupid when they gape. I wish they wouldn't do that—it pisses me off. It was rapidly cocking its goofy-looking head from side to side in arrogant fashion. Like this was my fault? I took a menacing step in the direction of that dingbat of a bird, but it wisely ran

off before I could grab and throttle it. If nothing else, I deprived it of a meal, and must remain content with that notion. And come to think of it, I did the same with the young gophersnake described earlier. Good!

Just after this incident, I was enjoying seeing more lizards in my back yard than ever before. So many were there, and so often did I see them, that I turned my back on the neighbors in favor of admiring my lizard friends. There would be as many as six whiptails at a time frolicking about, skittering, twitching spasmodically, and merrily chasing each other while seeking fornication privileges. This all was happening under the watchful eyes of Tree Lizards and Desert Spiny Lizards perched on the cinder block wall that surrounds my lordly trailer-trash estate. My back yard was a veritable lizard Shangri-La. And then it happened again. Only this time, *there were two of them*! In no time flat, it was "Ten little, nine little, eight little lizards, seven little, six little, five little lizards, four little, three little, two little lizards . . . one armed and dangerous geek!" The coup de grâce in the inner me occurred the day I gazed into my back yard and saw one of the mangy things by my bird watering station. It had a whiptail in its beak, and was merrily pounding it against the ground. Back and forth its head went, dashing that poor lizard into pieces. It would stop on occasion to hop on top of the water bowl, and take a drink of *my* water. This in order to help wash down big chunks of its ill-gotten gains. It was decided right then and there that this lizard annihilation bullshit was going to stop—right now! And the bad intent that raged through every fiber of my being must have emanated outward to that murderous swine of a bird, for it looked up at me, and our eyes locked. The bird was big and bad and mangy and bold, and I looked at him and my blood ran cold. I yelled "My name is Sue. How do you do? *And now you're gonna die*!"* I quietly stepped inside, and began the bumbling process of seeking—and eventually finding—my pellet rifle. This rifle (which I have named "Old Bess," Daniel Boone style) has a two-foot-long lever that is the pumping mechanism. One pump, and the pellet barely makes it out the barrel. Two pumps launch that same pellet about 50 feet. Ten pumps will go clean through the skull of a charging rhinoceros. While I do not fancy myself to be good shot by any means, there is something about Old Bess that will not allow me to miss—especially with ten pumps behind the pellet. On this day, I slammed a pellet into the chamber, and pumped it up ten times. When I went back outside, it was noted that the dirty bird was gone! Killing that roadrunner would not have mattered anyway, as the damage had already been done. The whiptail that bird was eating was the last remaining lizard in my yard. Once again, for a long spell, there was neither roadrunner nor lizard to be had anywhere near the Repp household.

It turns out that my old friend Bob Barry, may he rest in peace, was on to something. If you want lizards in your yard, you can't have roadrunners as well. That has been proven to me for two years in a row. Some frank discussions between me and institutions and private individuals who either keep lizards in outdoor enclosures, or like me, enjoy having lizards in their yard, have ensued. They *all* shoot, shovel and shut up. With my dilemma, shooting them would be the surest and easiest way to deal with them. But unlike Bob, I can't just bust out Old Bess and pop one. It is illegal to shoot a roadrunner anywhere due to the federal migratory bird laws. It is also illegal to discharge a firearm within city limits. These trivialities would normally not stop me any more than they stopped Bob, except that unlike Bob, I have too many witnesses around me. I am quite sure that my neighbors are spying on me. I sure do wish that they would mind their own business! But I can't just allow these birds to continue to ruin my lizard sanctuary without some sort of challenge.

Less than one week ago, I was once again sitting on my bench (for there was work to be done inside), when a *huge* Western Whiptail came wandering past. He paused near me, gave me a nod, and continued on into my back yard. He was a fine big fellow, pushing one foot in total length. No sooner did that one pass by, when another of equal size twitched its way past me and into the back yard. The following morning, I was watering the plants in the front yard, and disturbed a very large adult female Desert Spiny Lizard (*Sceloporus magister*). I knew she was a female because of her bright orange head, and greatly distended flanks. She is gravid. I have seen her several times since. She is living under the southwest corner of our house, and will probably drop her eggs there. Upon noting the arrival of this latest batch of lizards, I gathered a pile of palm-sized rocks, and placed them on that bench. I am now prepared at any moment to step outside and start zinging fastballs at roadrunners. Two times during the course of writing this paragraph, I have had to sneak outside that quiet door of mine. But this time, it was not because I was trying to avoid work. Both times, it was because I noted a roadrunner skulking about just outside my office window. That is dangerously close to where my spiny lizard might be dropping her eggs. Since the lizards have returned, I have had five chances to hurl these rocks at roadrunners, and not two minutes ago I scored my first hit. Even though I am aiming to kill, this particular effort may have been exactly what was needed here. The rock grazed the cloaca of the stupid thing. There were a few feathers knocked loose, a startled squawk, and a hearty "**Bwa-ha-ha!**" coming from the rottenest depths of my soul as that startled bird jetted away at full throttle. It is probably still running as these words are written. **Good! And don't come back, or there will be more of the same!** At this moment in time, I feel like I could whip Tarzan. Each time that I have hurled a rock at one of these stinkers, I have come closer to nailing it. I almost hope that this last effort was *not* good enough to teach it a lesson. Yeah—come on back you *idiot*, and let me finish the job! Lest the reader be appalled by my actions, I remind you to look at the words of Bob Barry, which appear just after the first paragraph of this column. While I will stop short of the name calling, I *will* say "You of all people *should* understand." This here is Roger Repp, signing off from Southern Arizona, where the turtles are strong, the snakes are handsome, and the lizards are *all* above average. We aim to keep them that way!

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* Johnny Cash, vocalist, "A Boy Named Sue," by Shel Silverstein, recorded live in concert on February 24, 1969, at California's San Quentin Prison, side 2, track 3, on *At San Quentin*, Columbia Records.

Herpetology 2020

In this column the editorial staff presents short abstracts of herpetological articles we have found of interest. This is not an attempt to summarize all of the research papers being published; it is an attempt to increase the reader's awareness of what herpetologists have been doing and publishing. The editor assumes full responsibility for any errors or misleading statements.

METABOLIC HEATING IN SNAPPING TURTLE NESTS

M. D. Massey et al. [2019, Chelonian Conservation and Biology 18(2):145-152] note that metabolic heating caused by physiological processes during the development of oviparous embryos can raise nest temperatures above those of the surrounding substrate and may be sufficient to increase embryonic growth rates, influence sex ratios of hatchlings with temperature-dependent sex determination, and increase hatching success in seasonal environments. In sea turtles with large clutch sizes, metabolic heating can raise nest temperatures by as much as 6°C. However, no studies have directly investigated metabolic heating in any species of freshwater turtle. The authors investigated whether metabolic heating occurs in nests of snapping turtles (*Chelydra serpentina*) from southeastern Michigan, United States. A temperature logger was placed in the center of eight unaltered snapping turtle nests. A second temperature logger was placed at the same depth in the surrounding substrate 5 cm from the side of the nest chamber. Metabolic heating is more pronounced in nests with larger clutches, so they artificially increased the size of two additional nests using donor clutches of 11 and 21 eggs, respectively. Temperatures were recorded at 2-hr intervals until after the presumptive hatch date of all nests. Significant increases were found both in mean nest temperature and accumulated heat units for natural and experimental treatment nests during the last third of incubation. Further, in nests with experimentally increased clutch sizes, mean nest temperature was significantly greater than substrate temperature throughout incubation, suggesting that large nests also exhibit a thermal inertia that results in positive heat balance throughout development, at least in the soils studied.

MOVEMENTS OF DISTUBED RATTLESNAKES

E. Lomas et al. [2019, Herpetologica 75(2):153-161] note that anthropogenic disturbances often present novel habitat features to which the members of an existing population must adapt. The authors examined the effects of disturbance and habitat fragmentation on the movements of northern Pacific rattlesnakes (*Crotalus o. oreganus*) from 2006 through 2012 in southern British Columbia, Canada. They radio-tracked 44 adult male rattlesnakes through shrub-steppe, grassland, and dry forest habitats that varied from highly disturbed and fragmented to near pristine with little human interaction. Sources of disturbance were primarily associated with tourism (golf course, campground, hiking trails, roads, parking lots, vineyards, condominium complex). After accounting for interyear variation and daily temperature, rattlesnakes in undisturbed areas had larger home ranges (100% minimal convex polygon) and longer home-range lengths compared to individuals frequenting minimally to highly disturbed areas. Contrary to the authors' predictions, snakes in highly disturbed sites did not move greater total distances, display elevated movement frequencies, higher movement rates, and/or more convoluted movement patterns.

SUBSTRATE INFLUENCES ON TURTLE NESTS

T. S. Mitchell and F. J. Janzen [2019, Herpetologica 75(1): 57-62] note that temperature-dependent sex determination, where egg incubation temperature irreversibly determines offspring sex, is a common sex-determining mechanism in reptiles. Weather is the primary determinant of temperature in reptile nests, yet the effects of weather are mediated through the nest microhabitat selected by the mother (e.g., overstory canopy cover). One potentially important aspect of the nest microhabitat is the physical substrate used for nesting. However, the influence of substrate type on nest temperature and offspring sex determination has never been experimentally assessed in the field. The authors incubated eggs of painted turtles (*Chrysemys picta*) in three substrate types similar to those commonly selected for nesting within our study population. Within a single study site, they constructed pits, which were refilled with loam, sand, or gravel. Then, they created artificial nests in each substrate type, and randomly assigned eggs to a substrate treatment. Substrate type influenced nest temperature and soil moisture, and affected incubation duration, but no other phenotype measured beyond offspring sex ratios. The cooler loam yielded the most male-biased outcome. This finding illustrates the potential importance of nesting substrate as a component of nest-site choice and as a factor in modeling future nest-temperature scenarios.

DEAD TADPOLES INFLUENCE FUTURE GENERATIONS

K. S. Pfennig and D. W. Pfennig [2020, Copeia 108(1):116-121] note that nongenetic inheritance—involving epigenetic, behavioral or environmental factors—is increasingly viewed as being important in development and evolution. They describe a possible novel form of nongenetic inheritance in the tadpoles of the Mexican Spadefoot (*Spea multiplicata*): the transmission of information about the environment from dead individuals to living individuals of a later cohort or generation. When live tadpoles were exposed to the remains of desiccated conspecifics from a naturally occurring dry pond, it was found that they used phenotypic plasticity to adjust their development in ways that would increase their chances of escaping a drying pond. Specifically, compared to their siblings that were reared with soil lacking tadpole remains, those reared with soil containing desiccated conspecifics grew larger, developed faster, and were more likely to express an alternative, environmentally induced phenotype—a distinctive carnivore morph that is favored in rapidly drying ponds. The authors also found evidence of underlying genetic variation in the plasticity to produce carnivores, suggesting that this plasticity could mediate adaptive evolution when populations experience different environmental conditions. Such a tendency of living individuals to respond to cues associated with dead individuals from a previous generation may be vital in giving each generation a head start in their environment.

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UPCOMING MEETINGS

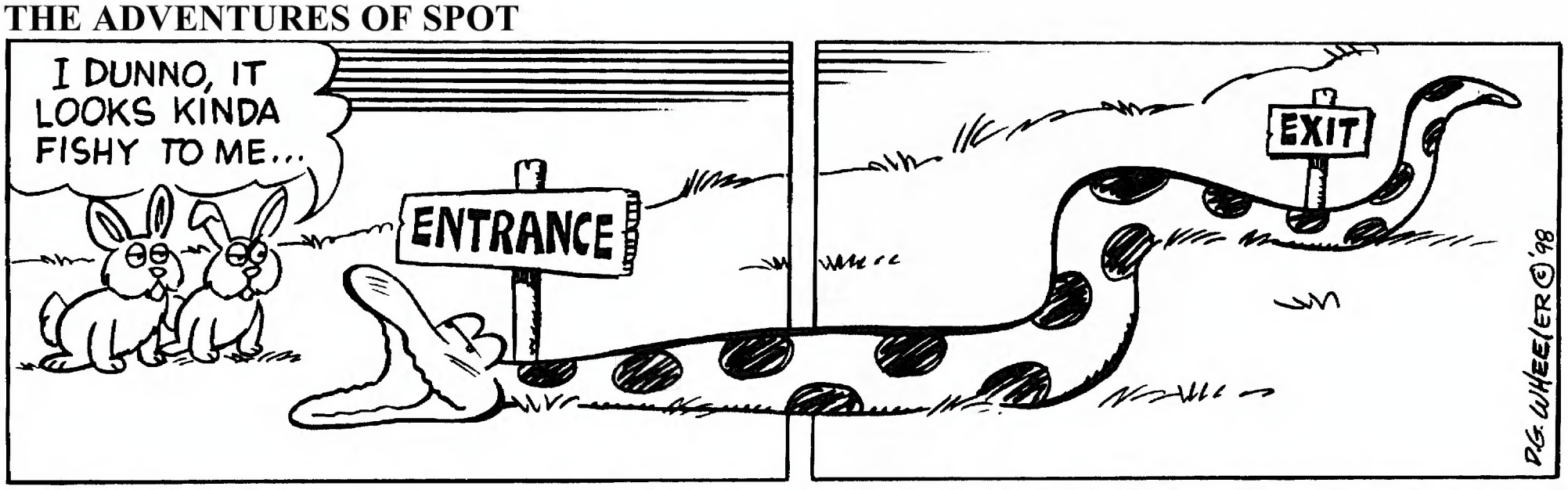
The July 29 and August 26 meetings of the Chicago Herpetological Society have been canceled.

The regular monthly meetings of the Chicago Herpetological Society take place at Chicago's newest museum—the **Peggy Notebaert Nature Museum**. This beautiful building is at Fullerton Parkway and Cannon Drive, directly across Fullerton from the Lincoln Park Zoo. Meetings are held the last Wednesday of each month, from 7:30 P.M. through 9:30 P.M. Parking is free on Cannon Drive. A plethora of CTA buses stop nearby.

Board of Directors Meeting

Are you interested in how the decisions are made that determine how the Chicago Herpetological Society runs? And would you like to have input into those decisions? The next board meeting will be held online. If you wish to take part, please email mdloogatch@chicagoherp.org.

THE ADVENTURES OF SPOT



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